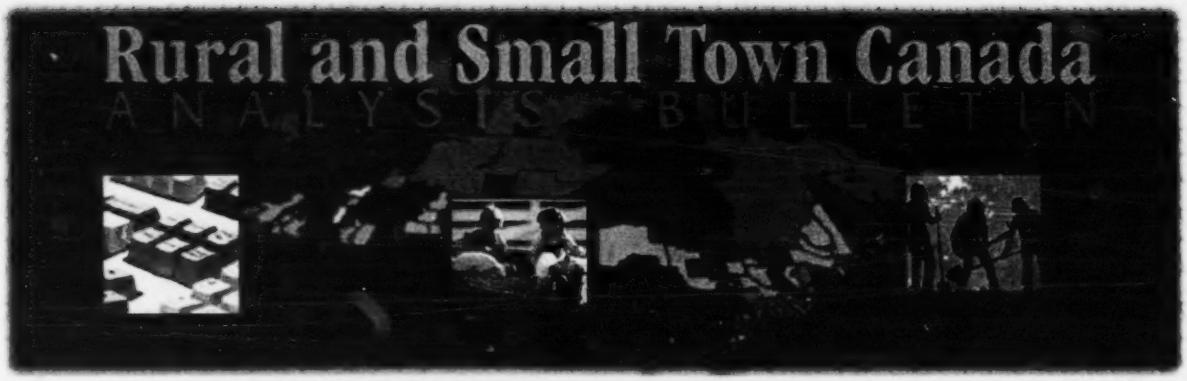

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Population Change Across Canadian Communities, 1981 to 2006
The Role of Sector Restructuring, Agglomeration, Diversification and Human Capital

Alessandro Alasia, Statistics Canada

Highlights

- **Primary sector restructuring and the strength of metropolitan agglomerations are two major drivers of changing population settlement patterns across Canada.**
- **Communities highly reliant on traditional sectors at the beginning of the 1980s (typically rural) experienced significant population downsizing. In contrast, communities with a higher share of employment in dynamic sectors (typically urban) experienced higher population growth.**
- **Sector restructuring has been paralleled by a steady process of agglomeration around urban centres. Although urban decongestion has occurred within high density regions, both proximity and population size of the nearest urban core are positively associated with population growth of their surrounding communities.**
- **Communities that were more diversified and had a higher educational attainment at the beginning of the 1980s experienced higher population growth over the following two decades.**
- **Community population change is determined both by *community* as well as *regional* characteristics; the latter in some cases reinforces community effects.**
- **Macro-regional differences are also evident: a pattern of change driven by restructuring and agglomeration describes the population dynamics of western Canada particularly well.**

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.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality

Introduction

During the 1980s and the 1990s, about one-third of Canadian communities[1] experienced continuous demographic growth, while another third experienced continuous population decline (Mwansa and Bollman 2005). The pattern suggests a divergent trend, with some communities steadily moving along a path of population and employment expansion, while others are progressively downsizing. A map of community level changes reveals the most striking feature of this spatial restructuring (Mwansa and Bollman 2005). Steadily declining communities are concentrated in peripheral and core rural regions, while steadily growing communities are highly concentrated in core urban regions. There has been considerable debate about the forces causing these changes and, even more so, to what extent these are inescapable forces of change (see for instance Polèse and Shearmur 2006).

The analysis presented in this bulletin suggests that there are two main forces that shape community population trajectories: sector restructuring and agglomeration. To some extent, these forces appear as the two faces of the same coin. Over the past two decades, the Canadian economy has undergone a substantial process of economic restructuring, characterized by continuous employment decline in traditional sectors, typically concentrated in rural and peripheral regions, and continuous employment growth in the so-called knowledge economy, typically urban-based.

Agglomeration forces result from the many economic advantages that accrue to firms and individuals who concentrate their activities in close proximity to each other (e.g., larger pool of human resources, access to strategic resources and the possibility to have continuous face-to-face interaction with clients and suppliers, etc.). Despite some sign of decongestion from urban cores to surrounding peri-urban areas, agglomeration effects have been pervasive and can be observed in their various dimensions. Population has generally shifted from lower to higher density regions. Communities located in the proximity of urban centres grew more than those further from an urban core, and those located close to larger urban agglomerations grew more than those located in proximity to small towns. Hence, *both proximity to and size of the urban core* had clear and distinctive effects on the demographic trajectories of communities.

Other than sector restructuring and agglomeration forces, two other factors are clearly associated with population changes: economic diversification and human capital. Communities that had a diversified economy and highly skilled labour forces *and* that were located in diversified and human capital-intensive regions grew faster (or declined less) than communities with opposite characteristics.

The findings indicate that both community *and* regional (i.e., surrounding communities) characteristics are associated with community demographic trajectories. In several cases, regional characteristics appear to reinforce community effects. This has implications for both research and development initiatives. Analysts and decision makers should focus on *communities in their regional milieu*, such as rural communities in rural regions (for example, a rural community in the Prairies), versus rural communities in urban regions (for example, a rural community in southern Ontario).

Finally, the findings appear remarkably stable across macro-regions of Canada. However, a model of community demographic change driven by restructuring and agglomeration fits the

1. In this bulletin, the term community refers to Census Consolidated Subdivisions (CCSs). See Box 2 for more details on community and regional definitions used in this bulletin.

population dynamics of western Canada particularly well.

These results highlight the economic viability and the challenge of sustainability for small and remote communities. Employment in traditional sectors and in low population density communities remains the salient feature of "rurality". Nonetheless, the analysis also indicates outliers to average trends. Community leaders may wish to use this type of information to conduct an assessment of their community and regional characteristics to develop realistic and pro-active demographic initiatives that build on community and regional assets.

The results presented in this bulletin are based on data from the 1981 and 2006 Census of Population (Box 1). After exploring the bivariate relationship between selected indicators and population change, a multivariate regression model is used to estimate the independent effect of each variable, once other community characteristics are controlled for (Box 2 for definitions and Box 4 for methodology). The model is estimated for the entire sample of communities and for sub-samples of rural and urban communities (Appendix Table A3) and for five macro-regions of Canada (Appendix Table A4). Results of a weighted regression, including regional and provincial dummies, are also reported (Appendix Table A5). They confirm the stability of the findings. The following sections discuss the main drivers of community population change in more detail.

Box 1 Data source

All the variables used in this analysis are from the ***Community and Regional Database 1981 to 2006***, a longitudinal database maintained by the Agriculture Division. The database contains over 200 socio-economic indicators defined for 2,607 communities and 288 regions with constant geographic boundaries over time. The Census of Population is the source of data for the Community and Regional Database.

For the community component, the data are tabulated at the Census Consolidated Subdivision (CCS) level, using constant 1996 census geography (see Box 2). Of the 2,607 CCSs existing in 1996, a total of 2,382 were retained for this analysis. The CCSs that were excluded are those for which some of the variables of interest were not available, due to data suppression for quality or confidentiality reasons (some census data are not released for CCSs with population less than 250 individuals). CCSs that are located in the Territories were also excluded from this analysis. For the purpose of this analysis the regional indicators are computed from the corresponding CCS indicators using the methodology described in Box 4. Finally, the distance variables used in this analysis are generated by GIS applications, using 1996 Census of Population geography.

For more information on the ***Community and Regional Database 1981 to 2006***, contact: Rural@statcan.gc.ca, or call toll free 1-800-465-1991 or fax (613) 951-3868.

Box 2 Key definitions

Community. In this bulletin, "community" is defined as a Census Consolidated Subdivision (CCS). The two terms, community and CCS, are used synonymously. CCSs are defined according to the 1996 census geography. Using constant 1996 boundaries, we have tabulated census data for the 1981 to 2006 period within these boundaries. It should be mentioned that Statistics Canada does not provide a standard definition for the term "community". The term is generically used to refer to administrative and statistical geographic units of small spatial extensions, and at an intermediate level between the provincial or regional level (economic regions, health region, Census agricultural regions, etc.) and micro-geographic levels such as dissemination areas, dissemination blocks or neighbourhoods.

Rural and urban community. In this bulletin, a rural community is a CCS whose geographic area is lying completely outside the boundaries of a Census Metropolitan Area (CMA) or Census Agglomeration (CA), defined according to the 1996 census geography. An urban community is a CCS whose geographic area falls completely or in part within the boundary of a Census Agglomeration (CA) or Census Metropolitan Area (CMA) as defined according to the 1996 Census geography.

Urban agglomeration. This term is used to identify a Census Metropolitan Area (CMA) or Census Agglomeration (CA) of any size. The boundaries of CMAs and CAs are defined according to 1996 census geography.

Region. For the purposes of this bulletin, for each community, we define its "region", or regional milieu, as a set of communities within a certain distance radius. To measure the characteristics of this region, for a given variable, we use a spatially lagged variable computed from the community indicator. Specifically, for each community (CCS), the corresponding regional indicator is computed as the weighted average of the indicator in the surrounding communities, where the weights are the inverse of the squared distance between community centroids (more details are provided in Box 4).

Macro-region. The term macro-region is used to identify a grouping of provinces which have common regional connotations, or individual provinces which have strong and distinctive regional connotations. We distinguish 5 macro regions, which are: *Atlantic* (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, and New Brunswick), *Quebec*, *Ontario*, *Manitoba and Saskatchewan* and the two western provinces, *Alberta and British Columbia*.

For more details, see Statistics Canada (1997).

The role of sector restructuring

Between 1981 and 2006 employment in agriculture declined from 437,600 to 346,400 workers and employment in other primary sectors declined from 349,400 to 330,100 workers.[2] In contrast, professional services employment, and business services employment grew approximately by a factor of 3 over the same period (from 410,000 to 1,122,000, and from 233,500 to 748,900, respectively)[3].

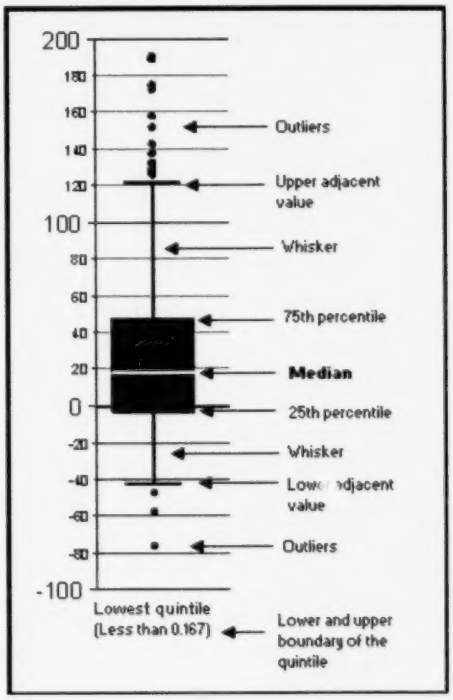
One constant in recent economic history has been the increasing value of human time (Schultz 1972). Specifically, the price of human time has been increasing relative to the price of machines. Consequently, producers of wheat and lumber and minerals and fish have substituted machines for labour. Communities dependent upon employment in these sectors have experienced a declining workforce. This pressure is expected to continue because the increasing value of human time is expected to continue. Consequently, communities that wish to maintain their workforce must find something new to export from their communities.

Not surprisingly, most communities heavily reliant on traditional sectors went through dramatic downsizing. Each column in Figure 1 represents a quintile (i.e. one-fifth of all communities)[4]. Most communities with the highest share of employment in primary sectors in 1981 (one-fifth had 33.5% or more of their workers employed in a primary sector) recorded a large population decline between 1981 and 2006 (Figure 1). In this group of communities, over three-quarters reported a population decline — the entire box is in the negative range for community population change in Figure 1.

2. Statistics Canada. CANSIM Table 282-0008. Labour Force Survey estimates (LFS), by North American Industry Classification System (NAICS), sex and age group. Other primary sectors include forestry, fishing, mining, oil and gas.
3. Statistics Canada. CANSIM Table 282-0008. Labour Force Survey estimates (LFS), by North American Industry Classification System (NAICS), sex and age group. "Professional services" include *professional, scientific and technical services* and "business services" include *business, building and other support services*.
4. In each of the charts, communities are grouped into quintiles – with one-fifth of the communities in each group. In Figure 1, communities are ranked by the share or percent of their 1981 employment in primary sectors. In 1981, the highest quintile (i.e. the one-fifth of communities with the highest share of employment in primary sectors) reported 33.5% or more of their workforce employed in primary sectors. Over three-quarters of these communities lost population between 1981 and 2006. This can be read from Figure 1 because the top of the "box" shows a population change (by looking at the vertical axis) of less than zero. See Box 3 to learn "How to read a box plot." One-half of the communities are within the box, one-quarter are above the box and one-quarter are below the box. The "whiskers" above and below the box show the range in outcomes (i.e. the range in the population growth rate from 1981 to 2006) for communities within each quintile. One conclusion that holds for every variable is that, regardless of the quintile class, some communities "succeed" (i.e. have higher outcomes) and some communities fail to succeed (i.e. have lower outcomes).

Box 3 Methods: how to read the box plots in this bulletin

Box plots have the advantage of showing both the median values as well as the dispersion of values for a specific grouping of communities.



To construct a box plot, first, each observation (community, in this case) is sorted from the smallest to largest in terms of the value of the indicator (or variable) along the horizontal axis. Quintiles are formed by placing the smallest one-fifth of the observations into the first quintile, the next one-fifth of the observations into the second quintile, and so on.

Thus, each quintile contains one-fifth of the observations, as classified by the variable along the horizontal axis. The values in brackets along the horizontal axis indicate the lower and upper range of the values for observations included in a given quintile (i.e., in terms of the value of the indicator or variable measured along the horizontal axis).

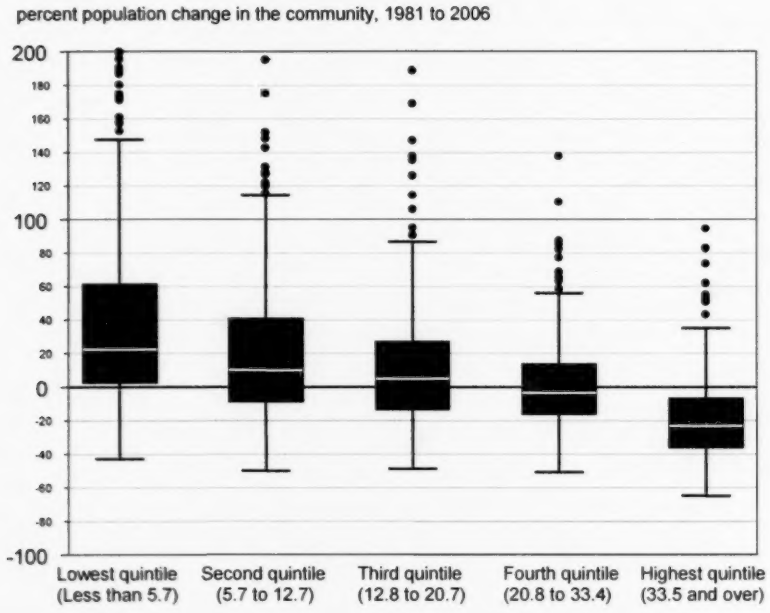
Secondly, the boxes, whiskers and dots in each quintile (in each column) report the values of the outcome indicator (or variable) as measured on the vertical axis. In this bulletin, the outcome variable is the percent change in total population of each community from 1981 to 2006.

The central line within each box indicates the value of the outcome indicator (or variable, as read along the vertical axis) for the median observation (community) within the given quintile. The median (or 50th percentile) is the value for which one-half of the observations have a higher value and one-half of the observations have a lower value. For boxes that are symmetric, the central line is likely to be similar to the average value of the outcome variable within the given quintile.

The central box shows the range in the values of the outcome variable (along the vertical axis) for the central 50% of observations (communities) when measured in terms of the values along the vertical axis. Within the box, there are 25% of the observations above the central line and 25% of the observations below the central line. The distance between the 25th and 75th percentiles (i.e. the height of the box, called the inter-quartile range) indicates the size of the spread in the outcome (vertical axis) variable that covers the "middle half" of the data. Boxes with a greater height means that a wider range of outcomes must be considered to include 50% of the observations.

The whiskers indicate the range or distribution of the outcome variable (as measured along the vertical axis) of the observations (communities) within the dataset that are outside of the middle half (i.e. outside those captured by the box). The whiskers extend upward from the top edge of the box and downward from the bottom edge of the box until each reaches a data point that is no further than 1.5 times the inter-quartile range (the height of the box), respectively. The terminal point of each whisker is called the upper or lower adjacent value, depending on which whisker is involved. Any data points above or below the end of the whiskers are considered outliers since these few communities have a rate of population growth that is unusually high or low relative to most of the communities in the data set (which are covered by the box and its whiskers). So, the whiskers represent the "outer" half of the data.

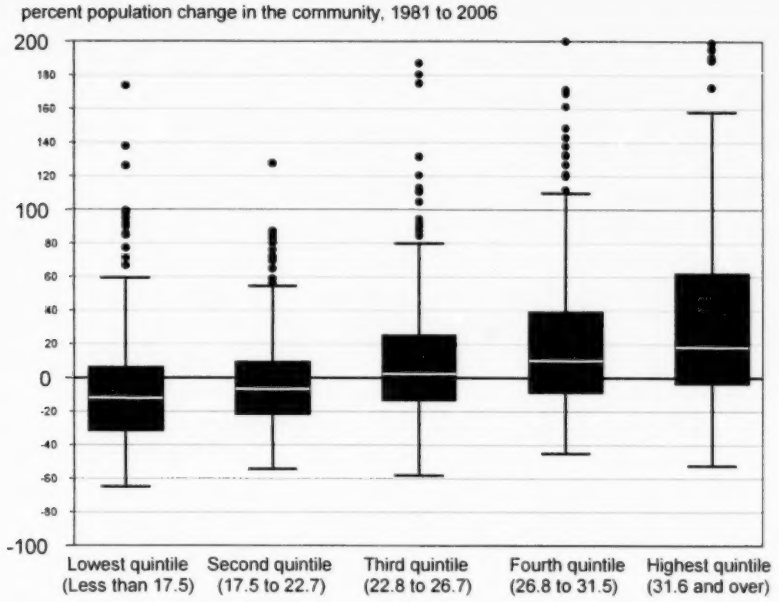
Figure 1 The typical community with a low employment share in primary industries grew by 24% while the typical community with a high employment share in primary industries declined by 23% from 1981 to 2006



Note: Primary industries include agriculture, forestry, fishing, mining and gas and oil extraction. See Box 3 to learn "How to read a box plot".
Source: Author's computation based on Census of Population data for 1981 and 2006.

The opposite trend is evident for employment in more dynamic sectors, here captured by employment in distributive and producer services. Among communities with 31.6% or more of their employment in these sectors (i.e. communities in the top quintile), about three-quarters of them recorded some population growth, as opposed to almost three-quarters of the communities with less than 17.5% of employment in these sectors which recorded some population decline (Figure 2).

Figure 2 The typical community with a low employment share in distributive and producer services declined by 13% while the typical community with a higher employment share in these sectors grew by nearly 20% from 1981 to 2006



Note: See Box 3 to learn "How to read a box plot".
Source: Author's computation based on Census of Population data for 1981 and 2006.

Box 4 Methods: a population growth model for Canadian communities

A regression model is used to determine the factors associated with community population change over the period 1981 to 2006. The population change between 1981 and 2006 is explained as a function of community and regional characteristics in 1981. The model is estimated in log-linear form, meaning that all variables are expressed either as logarithms or as dummy variables. The dependent variable is the logarithm of population change (where the change is computed as the ratio between population in 2006 and 1981); the explanatory variables are the logarithm of the level of each variable for the year 1981.

This functional form fits some of the data characteristics well, such as non-linear relationships and skewed distributions. Most importantly, the regression coefficients for the logarithmic variables can be interpreted as an elasticity, that is, the coefficient is the estimated percent change in the dependent variable due to a 1 percent change in the independent variable. The disadvantage, however, is the presence of zero values for some explanatory variables, for which logarithmic transformation is not possible. Although a relatively small proportion of observations have a zero for some variables (see Appendix Table A2), their presence needed to be addressed. For practical purposes, a dummy variable was used to assess the independent effect of presence/absence of the attribute. Then, the coefficient on the variable in each case was interpreted as the elasticity, given that the factor was present in the community. Following these considerations, the structure of the model that was estimated is as follows:

Box 4 Methods: a population growth model for Canadian communities (continued)

$$\ln(\Delta Pop_{1981-2006}) = \alpha + \beta_1 DSector^c_{1981} + \beta_2 \ln(Sector^c_{1981}) + \beta_3 \ln(Sector^r_{1981}) + \beta_4 \ln(Agglom^c_{1981}) + \beta_5 \ln(Agglom^r_{1981}) + \beta_6 \ln(SocioEco^c_{1981}) + \beta_7 \ln(SocioEco^r_{1981}) + \beta_8 DDemo^c_{1981} + \beta_9 \ln(Demo^c_{1981}) + \varepsilon$$

where, *Sector*, *Agglom*, *SocioEco* and *Demo*, represent a set of variables capturing employment structure, agglomeration, socio-economic and demographic characteristics, respectively. The superscript *c* indicates community level variables, the superscript *r* indicates regional level variables (computed as spatial lag variables), while *D* indicates dummy variables introduced to account for zero values in the data before the logarithmic transformation. Appendix Table A1 reports the exact definition of each variable used in the model while Appendix Table A2 shows the descriptive statistics at the community level.

This model is estimated for the entire sample of communities (2,382 CCSs) and for rural and urban sub-samples (Appendix Table A3) and five macro-regional sub-samples (Appendix Table 4). Finally, results are also presented for a weighted regression, using community population in 1981 as weights, and including provincial and macro-regional dummies (Appendix Table A5). The measures of fit indicate that the model has a good explanatory power, with a R^2 ranging from 0.51 to 0.73; hence, depending on the sample used, up to 73% of the observed variation in population growth is explained by the model. A similar model was also estimated for the period 1981 to 2001 using alternative specifications (linear form, and alternative variable definitions). The main findings remain substantially unchanged. These results are available from the author upon request.

Interpretation. In the specific case of this dataset, given that the mean of the independent variable is closer to zero (it is 10.71), the coefficient on an independent variable can be interpreted as the expected "percentage point change" in the population growth rate, due to a 1% change in the independent variable. A detailed explanation follows.

The coefficients on an independent variable in a double-log equation (i.e. when the dependent variable and the independent variables are each entered as logarithms of the variable in question) are interpreted as – if the independent variable was different by 1%, then the percent difference in the dependent variable is given by the value of the coefficient.

For example, in our results for all communities (Appendix Table A3), the coefficient for the variable measuring the level of regional educational attainment is 0.165. Thus, an increase in the regional educational attainment level of 1% would increase the dependent variable by 0.165%. Our dependent variable is the ratio of the population in 2006 divided by the population level in 1981. For example, a population decline of 15% gives a ratio of 0.85 and a population increase of 15% gives a ratio of 1.15. Thus, the regional educational attainment coefficient of 0.165 means that the ratio of 2006/1981 population would be higher by 0.165% if regional education attainment was higher by 1%. As noted in Appendix Table A2, the percent change in population for the average community is 10.71% -- which, as a ratio of 1.1071, was our dependent variable. With a 1% increase in the level of regional educational attainment, our coefficient of 0.165 indicates that this ratio will increase by 0.165%. The new ratio would be 1.1071 plus (1.1071*(0.165/100)) = 1.108927. Thus, the percent change in population in this scenario would be 10.89%. The increase in the rate of population change is (10.89 – 10.71) = 0.18 percentage points. This value is approximately equal to the coefficient of 0.165.

The short story of the long explanation above is that since the mean of the independent variable is "close" to zero, the coefficient on an independent variable can be interpreted as the expected "percentage point difference" in the population growth rate due to a 1% change in the independent variable.

Box 4 Methods: a population growth model for Canadian communities (continued)

The coefficient on a dummy variable can be transformed to compute the shift in the dependent variable when the attribute is present. For example, if the coefficient (β) of a dummy is 0.2, when the dummy takes the value 1 the dependent variable is (Exp(β)-1) = 0.22 percentage points larger than otherwise.

Regional indicators. While the community variables are variables at the CCS level, the regional variables are spatial lags computed from the corresponding CCS indicators and a matrix of distances between each pair of communities. Specifically, spatial lags are computed as distance weighted averages of the values reported by neighbouring communities, where the weights are the inverse of the squared distance between community geographic centroids. A threshold distance of 1,000 kilometres is used to limit spatial interaction and beyond this threshold, the interaction is assumed to be zero (for details, see Alasia *et al.* 2007). The regional variable includes all the values of the neighbouring communities but not the value of the community itself. This approach mitigates the effect of any imposed administrative geography in defining the regional dimension, while at the same time accounts for the fact that regional interactions decay as distance increases. Thus, the role of neighbouring communities declines as one gets further and further from the observed community.

The regression model confirms these patterns (Appendix Table A3, A4 and A5). For *rural communities* with some employment in agriculture, holding other factors constant (including the index of specialization), a 100% higher employment share in agriculture, was associated with a 3.7 percentage points lower population growth rate.[5] For instance, compared to the *average rural Canadian community*, with 18% employment in agriculture and about 2%

5. As explained in Box 4, the β coefficient for each variable in Appendix Tables A3, A4 and A5 is approximately equal to the "percentage point change" in the expected rate of population growth due a 1% change in the level of the given variable. In the third column of Appendix Table A3, the β coefficient for the share of agricultural employment in the community is -0.037. Thus, a rural community would have an expected population growth rate that is 0.037 percentage points lower compared to a community with a 1% higher share of employment in agriculture. For example, compared to the average rural community with an agricultural employment share of 18.27% (Appendix Table A2), a community with a 1% higher share would have 18.45% employed in agriculture (i.e. 18.27 plus 1% of 18.27). This community would have an expected population growth rate that was lower by 0.037 percentage points. Or, as indicated in the text above, a community with a 100% higher agricultural employment share (say, comparing the average community with an agricultural employment share of 18.27% with a community with a 100% higher share (i.e. 36.54%)) would have an expected population growth rate that was 3.7 percentage points lower. Again, looking at the average rural community population growth rate of 1.8% (Appendix Table A2), this community would have an expected population growth rate of -1.9% (i.e. 1.8% minus 3.7 percentage points).

population increase between 1981 and 2006, a community with identical characteristics but 36% employment in agriculture (100% higher employment share), was expected to experience a population decline of almost 2% over the same period.

For rural communities, a difference in the share of community employment in other primary industries had an even larger impact on population growth. Compared to the *average rural community* (with about 6% employment in other primary industry and about 2% population growth), a rural community with 12% employment in other primary industries was expected to experience about a 4% population decline (holding other factors constant).

The regional context reinforces these employment effects. Specifically, employment in the agricultural sector is typically dispersed across communities within a region, while it is less so for other primary industries where the employment is likely to be concentrated in specific communities. For rural communities, each 10% difference in the share of employment in agriculture in 1981 in their region is associated with a population growth that is almost 0.6 percentage points lower between 1981 to 2006 (other factors remaining constant). This result mainly reflects employment multiplier effects across communities. For instance, a community with a relatively diversified economy located in a highly agricultural dependent region such as the Prairies, is likely to have been affected by the restructuring of the agricultural sector in the region, even though the community's workforce was not directly employed in agriculture.

For the large majority of communities that had some employment in distributive and producer services in 1981, the community effect is generally positive and statistically significant. For instance, compared to the *average rural community* (with about 18% employment in distributive services and 4% employment in producer services), a rural community with about 36% employment in distributive services *or* 8% employment in producer services had an expected population growth of about 5 or 3 percentage points higher, respectively (holding other factors constant).

The role of agglomeration

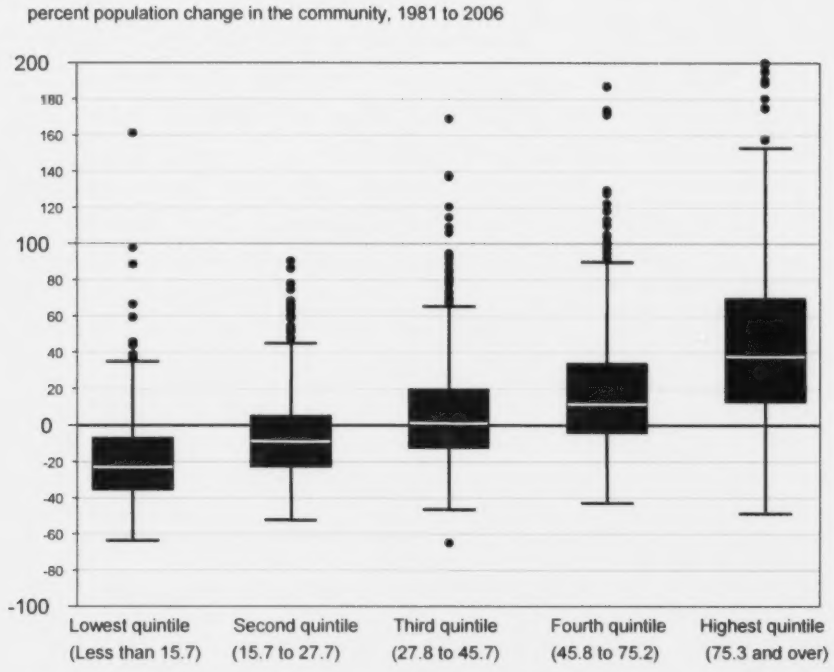
Historically, Canada has been characterized by sparse population settlements, many of which were developed to harvest or mine natural resources. While this industrial structure has changed progressively over time, the surge of the "knowledge economy", which is largely an urban phenomenon, has added a new dynamic to this transformation. Urban agglomerations have acquired a key role in leading regional growth. Economic density, proximity to and the size of the urban core are all key indicators of the underlying process of agglomeration that is driving population re-location.

About three-quarters of the communities with lower population density (below 2.1 people per square kilometre in 1981) experienced a population decline over the 1981 to 2006 period (data not shown). In contrast, about three-quarters of the communities with higher population density (above 28 people per square kilometre) experienced population growth. All the communities with population density above 1,000 people per square kilometre recorded some population growth.

The relationship between density and growth is also strong when considering the density of the region in which the community is located, regardless of the density of the actual community. Over three-quarters of the communities that were located in regions in the top quintile with more than 75 people per square kilometre in 1981 experienced population growth between 1981 and 2006, while the opposite holds for communities located in regions with less than 16 people per

square kilometre (in the lowest quintile) (Figure 3). However, note the variation within each quintile of regional population density. Not all communities in low density regions suffered population decline and not all communities achieved population growth if they were in regions with a high population density.

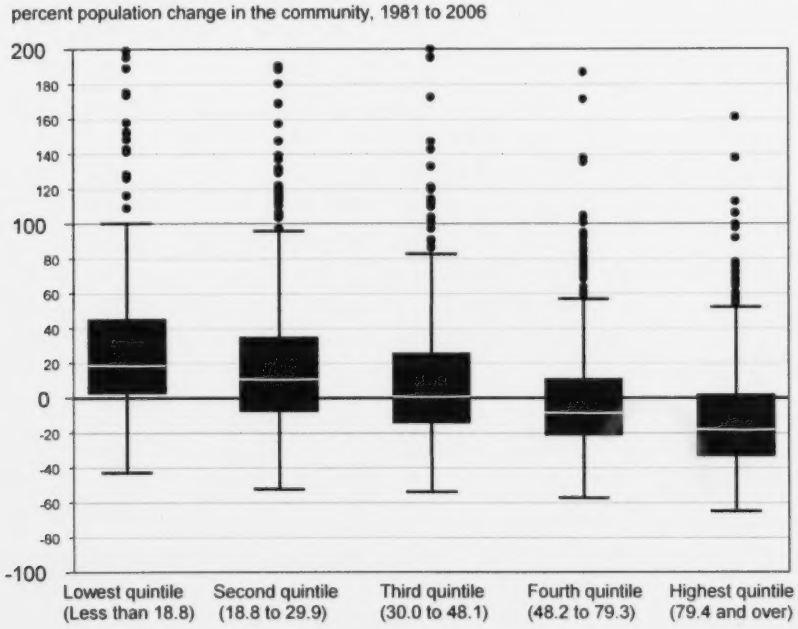
Figure 3 The typical community in a low density region declined by 22% while the typical community in a high density region grew by almost 40% from 1981 to 2006



Note: See Box 3 to learn "How to read a box plot".
Source: Author's computation based on Census of Population data for 1981 and 2006.

Communities located at a greater distance from an urban core (CMA or CA) grew less over the 1981 to 2006 period than communities located in proximity to an urban core. For example, about three-quarters of communities within 30 kilometres from an urban core had positive, and often large, population growth (Figure 4). A strong negative gradient is evident as we move away from an urban agglomeration. Almost three quarters of communities that were located more than 80 kilometres away from an urban agglomeration of any size experienced population decline between 1981 and 2006.

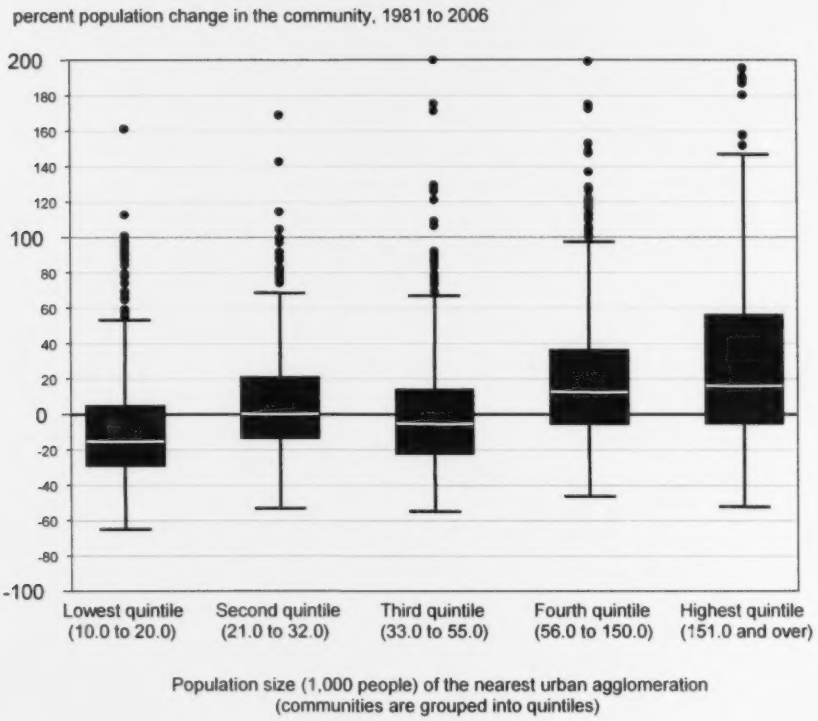
Figure 4 The typical community in close proximity to an urban centre grew 19% while the typical community beyond 80 kilometres from an urban centre declined by 18% from 1981 to 2006



Note: See Box 3 to learn "How to read a box plot."
Source: Author's computation based on Census of Population data for 1981 and 2006.

Beside proximity to an urban core, the size of the urban core is also positively associated with population growth of the surrounding communities or the urban core itself. About three-quarters of communities in proximity to an agglomeration of 10,000 to 20,000 inhabitants had a population decline or a marginal growth over the 1981 to 2006 period, while the same share of communities in proximity to agglomerations over 150,000 inhabitants experienced sustained population growth (Figure 5). Thus, both distance and size of the nearest CMA/CA matter in determining demographic population growth of a community. On average, communities in the shadow of larger urban areas experienced higher growth than communities in the shadow of smaller agglomerations.

Figure 5 The typical community in the shadow of small urban centres declined by 18% while the typical community in the shadow of a large agglomeration grew by 15% from 1981 to 2006



Note: See Box 3 to learn "How to read a box plot."
Source: Author's computation based on Census of Population data for 1981 and 2006.

When the relationship between population growth and agglomeration factors is assessed in a multivariate framework, the significance of these relationships is further confirmed and quantified (Appendix Tables A3, A4 and A5). In a multivariate framework, the agglomeration process appears best captured by proximity of the community to an agglomeration and the population size of the nearest agglomeration. However, the population density of the community, itself, has a negative association with population growth, suggesting a process of urban decongestion experienced by most of the urban agglomerations across Canada.

Distance to an urban core has a statistically significant effect both when small and large agglomerations are considered. Compared to the *average community of Canada* (located 264 kilometres from a large agglomeration), communities that are 10% further away from a large urban core (i.e. about an additional 26 kilometres away) had an expected population growth approximately 1 percentage point lower between 1981 to 2006 (other conditions being the same) (Appendix Table A3). In contrast, a community with similar characteristics but located 130 kilometres from a large urban centre (i.e. about a 50% reduction in distance) had an expected population growth about 5 percentage points higher. Distance to smaller metro areas

(with a population of less than 500 thousand people) also has a significant effect on community growth.

The size of the nearest agglomeration matters. Compared to the average community (located in proximity of an agglomeration of 150,000 people), a community located near a centre that is 100% larger (i.e. 300,000 people) had an expected population growth approximately 1 percentage point greater, from 1981 to 2006 (other factors being the same) (Appendix Table A3). Thus, communities located in the shadow of large urban centres have, on average, benefited from the process of agglomeration in the core urban region. However, once agglomeration factors are accounted for, local population density appears to have a negative effect on population change, which can plausibly be explained in terms of a decongestion process captured by this indicator.

Agglomeration has both benefits and costs. Recently, economists have paid a great deal of attention to economic density, suggesting that growing population density is strictly correlated to a growth in productivity. For instance, a U.S. study indicates that doubling employment density increases average productivity by around six percent (Ciccone and Hall 1996). Higher employment density has also been linked to increased innovation due to external economies generated by the interactions among the skilled and experienced labour force (Jacobs 1969). These findings are the result of a variety of agglomeration economies. For instance, a firm, located in proximity to a research centre has the opportunity for face-to-face interaction with analysts, which may be only poorly substituted by long-distance communication in the early stage of development of an idea. Similarly, pooling together researchers in close proximity facilitates knowledge sharing and further development of new ideas. In a knowledge driven economy, these are increasingly important forms of agglomeration economies.

On the other hand, sociologists and urban economists have challenged the assumption that high density reduces the cost of service delivery, once a minimum threshold is reached (Ladd 1992). High density may also result in high social costs, such as long times spent commuting, environmental costs and increased crime rates, etc.

While the net economic effect of agglomeration remains a matter of debate, the forces that determined these trends in the past two decades are likely to persist in the foreseeable future. Agglomeration (i.e., urbanization) economies are now contrasting more than ever with the lack of agglomeration economies in thin rural labour markets; a challenge that rural communities have to face.

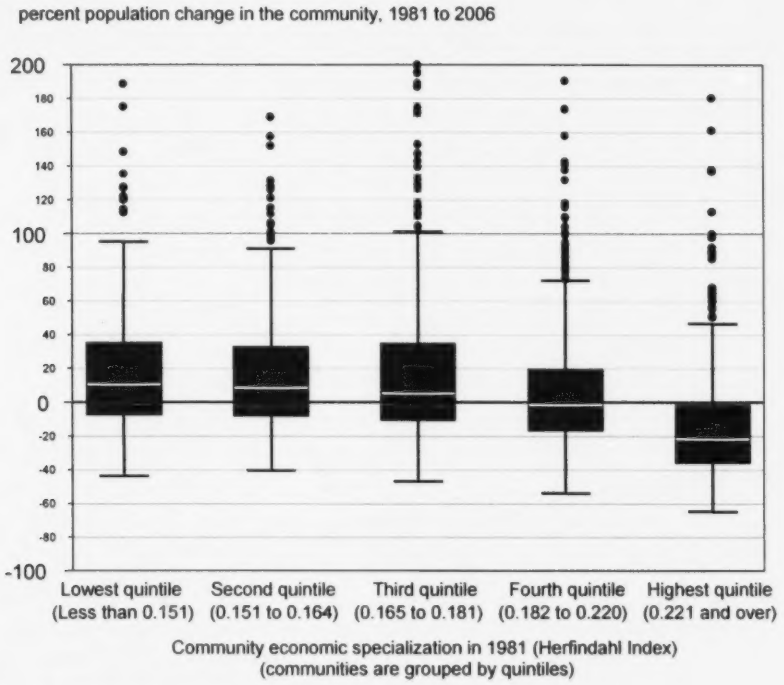
The role of economic diversification

Efforts to diversify the local economic base have been the cornerstone of local economic development programs and, according to the results supported by the model in this analysis, rightly so. Communities with a diversified industry composition at the beginning of the 1980s were able to grow faster than localities that were specialized in specific sectors, regardless of the sector of specialization.

Figure 6 shows the relationship between the index of economic specialization[6] of a community in 1981 and the population growth experienced by that community during the following two decades. Low values of the index imply economic diversification, while higher values indicate economic specialization. In the highest quintile, that is the communities with the highest economic specialization, just over three-quarters of the communities experienced population decline.

6. The index of economic specialization used in this analysis is the Herfindahl Index (see Appendix Table A1).

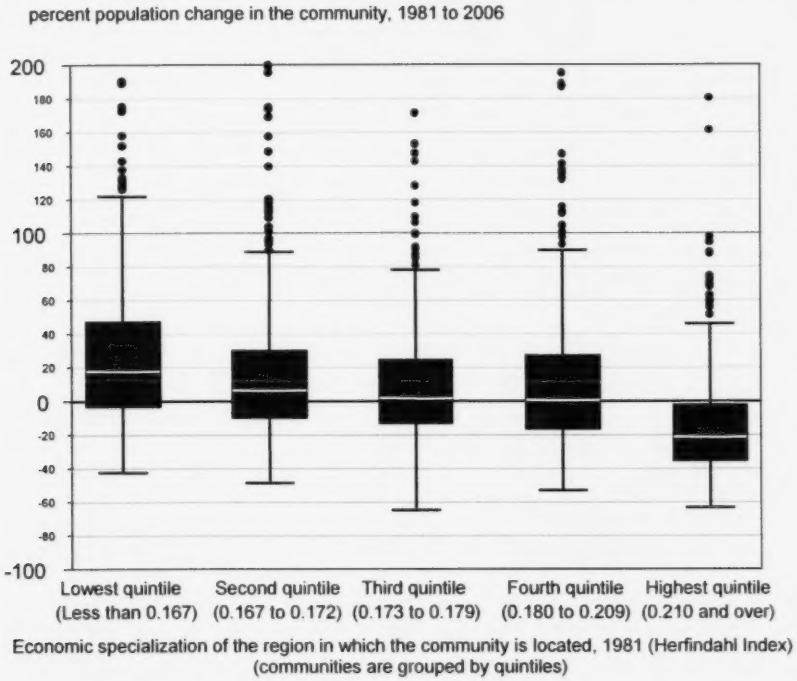
Figure 6 The typical community with a more diversified economy grew by 11% while the typical community with a highly specialized economy declined by 22% from 1981 to 2006



Note: See Box 3 to learn "How to read a box plot"
Source: Author's computation based on Census of Population data for 1981 and 2006.

Regional diversification matters. In fact, the relationship between growth and diversification is even more evident when communities are classified according to the economic specialization of the region in which they are located (Figure 7). Over three-quarters of communities in a region with a diversified economy in 1981 (a Herfindahl Index less than 0.167) had a positive population growth in the following two decades. This is opposed to the communities located in a region with a specialized economy (Herfindahl Index of 0.71 and over) where about three-quarters of the communities experienced a population decline.

Figure 7 The typical community located in a diversified regional economy grew nearly 20% while the typical community located in a specialized regional economy declined 20% from 1981 to 2006



Note: See Box 3 to learn "How to read a box plot."
Source: Author's computation based on Census of Population data for 1981 and 2006.

A multivariate analysis reinforces these findings. Holding other conditions constant, communities that had more diversified economies at the beginning of the 1980s were more likely to expand their population base. Compared to the average community, a community with a specialization index that was 10% lower (i.e. a lower Herfindahl Index) could expect a population growth of about 2 percentage points higher between 1981 to 2006 (Appendix Table A3). Among all the factors considered, community population change was most sensitive to the level of community specialization (i.e. it had the largest coefficient). It should also be noted that this is the only factor, together with distance to major urban agglomerations, which showed highly consistent and significant effects across the macro-region models (see Appendix Table A4).

Once other factors are controlled, the degree of regional economic diversification also plays a significant role in determining the population change trajectories of communities. When the entire sample is considered (Appendix Table A3), a 10% higher index of regional economic specialization is associated with about a 1.8 percentage point lower community population growth rate, other factors being the same.

This result supports the old wisdom of local development practitioners: community economic diversification is one of the main strategies for long term sustainability. Although several communities with specialized employment in specialized regions achieved high rates of population growth (note the height of the whiskers in Figures 6 and 7), the overall pattern shows that a diversified economic base and a

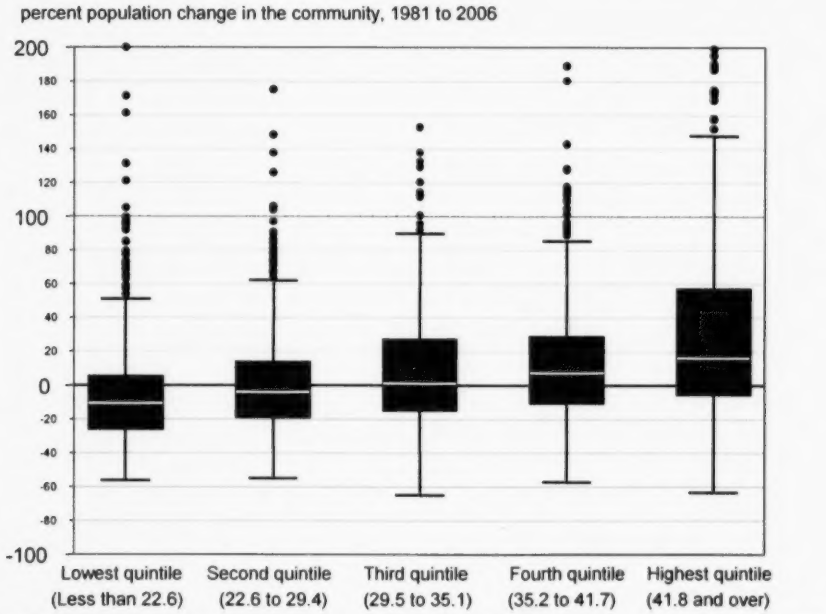
diversified regional economy are key factors in shaping community population trajectories. Over the long-run, economic diversification is an asset that facilitates community adjustment to economic change, and increases the likelihood that the community will be able to maintain and expand its population base.

The role of human capital

A question that has attracted a great deal of attention has been the role of human capital in fostering local development. The focus on human capital has been boosted by the evidence of the steady process of knowledge intensification across all the sectors of the Canadian economy. For example, during the 1990s, higher skills occupations such as managerial and professional occupations have grown 36% and 17% respectively, in contrast to lower skills occupations which have grown generally less than 10% (Alasia and Magnusson 2005). It is not surprising then to observe that human capital indicators had a strong and positive association with long-term population growth of a community.

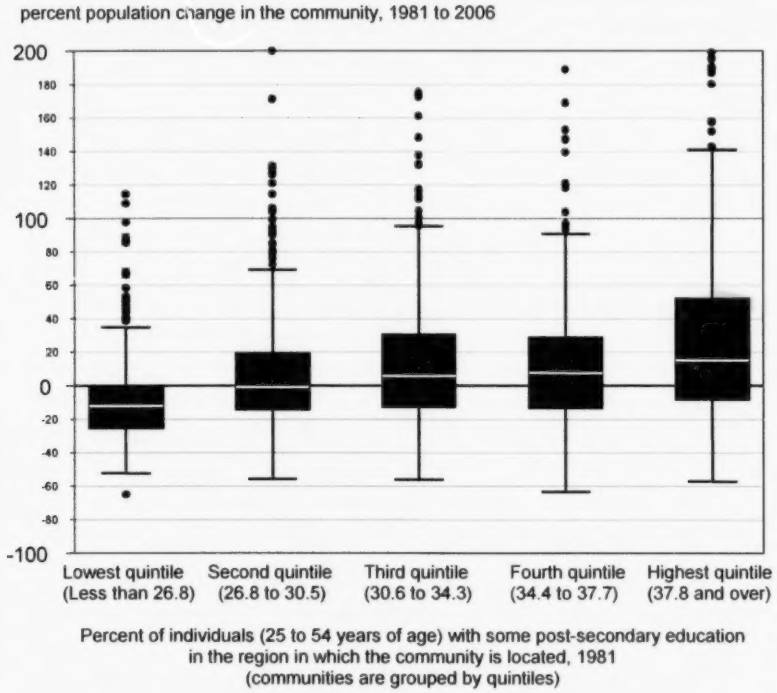
The relationship between community population growth and local human capital is shown in Figure 8 and the relationship between community population growth and regional human capital is shown in Figure 9. The share of individuals with some post-secondary education in 1981 is used here as a proxy of human capital. For both graphs a clear positive gradient is evident, with communities in the bottom quintile of the human capital distribution experiencing mainly population decline over the two decades.

Figure 8 The typical community with a lower share of post-secondary graduates declined by 10% while the typical community with a higher share of post-secondary graduates grew by 16% from 1981 to 2006



Note: See Box 3 to learn "How to read a box plot."
Source: Author's computation based on Census of Population data for 1981 and 2006.

Figure 9 The typical community located in a region with a lower share of post-secondary graduates declined by 12% while the typical community located in a region with a higher share of post-secondary graduates grew by 15% from 1981 to 2006



Note: See Box 3 to learn "How to read a box plot."
Source: Author's computation based on Census of Population data for 1981 and 2006.

Human capital has been typically concentrated in urban regions. Hence, it could appear that human capital is proxying the effect of agglomerations. Nonetheless, when the relationship between population change and human capital is assessed in a multivariate framework, after controlling for agglomeration factors and other local and regional characteristics, human capital turns out to have an independent, distinctive and significant effect on population growth (Appendix Tables A3, A4 and A5).

Holding other factors constant, compared to the *average Canadian community* (32% of individuals with some post-secondary education in 1981), a community with an incidence of higher education that was 10% higher (that is about 35% of individuals with post secondary education) had about a 0.5 percentage point higher rate of population change over the 1981 to 2006 period.

A second relevant finding is that, along with the local human capital factor, the level of human capital in the region in which the community is located had a distinctive and significant effect on the growth perspective of a locality. In fact, for both rural and urban communities, being located in a region with a higher level of human capital had a larger effect on local growth than the human

capital endowment of the community itself (Appendix Table A3). Other conditions being the same, a 10% higher share of individuals with some post-secondary educational attainment in the region was associated with between a 1 and 3.6 percentage point higher community population growth rate over the following 25 years.

These findings are consistent with other research on population changes, showing that a high concentration of human capital was associated with higher regional population growth. For instance, Glaeser (2005) shows that the number of colleges per capita in metropolitan areas is a good predictor of population growth. Metropolitan areas with twice as many colleges in 1940, compared to peer areas, witnessed four percent faster population growth per decade after 1970.

These findings suggest that, other conditions being the same, higher growth rates are associated with higher skill levels. As human capital becomes more important for firms operating in any sector, there are further incentives for firms to locate in regions where this input is abundant (Alasia and Magnusson 2005).

Other factors

The multivariate framework used to assess patterns of community population change includes some additional socio-economic and demographic variables. For example, the community labour force participation rate (as defined in Appendix Table A1) is positively associated with population growth, although only statistically significant in a few cases. A significant association would suggest that communities with a higher share of the population with jobs in 1981 had a higher population growth in subsequent periods.

Demographic characteristics did have some impact on the long term perspective of growth. For urban communities, a higher share of children (under 15 years of age) in the population in 1981 was associated with a higher subsequent population growth rate. For rural communities, a higher share of seniors in the population was associated with a high population growth rate after 1981.

Communities that attracted more young adults and more early retirees in the 5 years before 1981 reported higher population growth in the 1981 to 2006 period. The capacity to attract young and senior people appears to be a sign of robust demographic dynamics for a community.

Finally, urban communities with Aboriginals as a higher share of the population in 1981 grew less in the subsequent period whereas rural communities showed the opposite pattern – rural communities with a higher share of Aboriginals in 1981 grew more following 1981.

Communities and their regional context

A point that should be emphasized is that community population trajectories can be determined by local as well as regional characteristics. This analysis pays specific attention to this local/regional dimension by using a set of spatially-lagged indicators which, for each community, calculates the level of the characteristic for the region surrounding the community. These variables indicate an important distinction between community and regional effects (details are presented in Box 4).

For instance, a community may have a relatively small pool of human capital, but at the same time it may be located in a region with high levels of human capital, which can facilitate the community's capacity to stabilize demographic trends. Similarly, a community that has a relatively low share of employment in primary sectors may be located in a region with a high share of employment in these sectors. A typical

example could be a small town in the Prairies surrounded by farming communities. Also, in this case, the regional context is likely to have a strong influence on community trends.

The results of the modeling analysis support this view. Although these findings should be considered as only a first step in this direction, they appear promising. In several cases, the effect of the regional indicator reinforces the community effect. This is the case of agricultural employment, human capital and, in some cases, economic specialization.

A key insight that should be emphasized has implications for both research and community development practice. Both analysts and decision-makers involved in community development should focus on communities *and* on the regional milieu of a given community.

Regional differences and outliers

The relationship between community population trends and explanatory variables described in the previous sections appears fairly stable across macro-regions of Canada (Box 2 defines macro-regions). There are some differences that should be noted. To investigate these differences, the same regression model applied to all Canadian communities was used for the communities within each of the five macro-regions of Canada.

For each macro-region, namely Atlantic, Quebec, Ontario, Manitoba / Saskatchewan, and Alberta / British Columbia, the statistically significant relationships between dependent and explanatory variables are similar to the patterns observed for the country as a whole; even though the magnitude of the coefficients vary to some extent, these appear also relatively consistent (Appendix Table A4). Restructuring and agglomeration forces are shifting population from rural and relatively remote areas, dominated by traditional sectors, to the vicinity of urban agglomerations dominated by dynamic sectors. However, agglomeration forces appear particularly relevant for the Manitoba / Saskatchewan macro-region.

Moreover, the model describes the behaviour of the communities of the four western provinces remarkably well. For these macro-regions the model explains 67% and 73%, respectively, of the observed variation in population growth. The estimate for Alberta / British Columbia shows a particularly high coefficient for community and regional educational attainment, suggesting that the critical mass of human capital in the early 1980s has been a key factor associated with the growth of the following 25 years. Overall, the results for the four western provinces suggest that the ongoing process of agglomeration might have a greater bearing in determining future population trends in this part of the country, as compared to other macro-regions such as Ontario and Quebec which have already achieved significant population densities in certain areas.

For the other macro-regions, the model does not fit as well as for the four western provinces, although the strength of the results is generally good for this type of a cross-section analysis.

Conclusions

Over the 1981 to 2006 period, population growth across Canadian communities was remarkably uneven. The economic restructuring of the Canadian economy has been paralleled by a significant spatial restructuring of population patterns, whose key feature was a steady process of agglomeration of population and employment in and around urban centres.

Rural depopulation trends raise concerns about the future viability of many rural communities. Population decline reduces the density of economic activities and poses further challenges to the economic sustainability of many communities. For small settlements, further

downsizing makes it difficult to retain, let alone expand, basic services in the community and for the services that are retained, delivery costs may increase to unbearable levels. In the long run, this pattern of decline may threaten the quality of life of the population residing in these areas.

This bulletin discusses the factors associated with community population changes. Community leaders can use this information to conduct an assessment of their community and regional characteristics and develop realistic but pro-active initiatives for population stabilization that account for and build on local and regional assets. The main findings can be summarized as follows.

- Communities that had a higher share of employment in primary sectors and a poorly diversified economic base faced a steady population decline.
    - As capital intensification of primary sectors is likely to persist in the future, this trend is also likely to persist; rural communities need to find new commodities or services to export in order to maintain their employment and population base.

- Both proximity and size of the nearest urban agglomeration have an effect on community population growth.
    - Overall, population shifted from lower to higher density regions, although within the higher density regions growth was higher outside the urban core. The communities that had faster growth were those in proximity to urban areas, and among these, those located closer to larger urban agglomerations grew the fastest.

- Communities that started with a higher concentration of human capital had an advantage in terms of population dynamics.
    - Evidence indicates that skilled labour has concentrated in urban agglomerations over the past two decades. Expanding and improving local human capital to respond to the needs of a knowledge-intensive economy may remain a key strategy for any type of community.

- For each community, the regional context matters in determining local trajectories of growth.
    - This might appear trivial but the regional dimension in community-level analysis is in some cases overlooked. Instead, these results have implications for governance, development initiatives and research. Analysts should focus on communities in their regional context, such as rural communities in a rural region versus those in an urban region. The challenges and opportunities for *similar* communities in *different* regional contexts are substantially different.

- The relationship between community population change and the variables associated with population change appears to be stronger in western Canada.
    - Here, economic density and agglomeration size is still relatively modest in comparative terms. Larger agglomerations in western Canada appear to be far from congestion thresholds.

- The descriptive analysis shows that there are success stories within each group of communities.
    - Regardless of how we have classified communities, we (almost) always find some communities with population growth and some communities with population decline. There is a wide range in the size of community population change. Thus, some

communities have "succeeded" and some communities have "not succeeded" with each of the groups we have portrayed.

Besides identifying broad forces of change (and with a focus on the average community in each group), this bulletin also highlights the variation of population growth performance (i.e. there are specific factors in these communities that we are not taking into account). Community development practitioners and researchers alike may have a lot to learn from the specific factors in these communities in order to determine whether these specific experiences can be replicated in another community.

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Appendix Table A1 The variables used in this study

Indicator	Description and specification
Dependent: population change, 1981 to 2006	This is the rate of change of the total non-institutional population between 1981 and 2006, calculated as the ratio of 2006 population divided by the 1981 population. For the regression model, the dependent variable is the logarithm of the 2006 population divided by the 1981 population level.
Sector restructuring factors	
Presence of agriculture (dummy)	Dummy variable; takes value of 1 if the community has a percent of experienced[1] labour force in agriculture greater than zero, and value of 0 otherwise.
Community agriculture (%)	Percent of experienced[1] labour force in agriculture in 1981 at the CCS level.
Regional agriculture (%)	Spatial lag of percent of experienced[1] labour force in agriculture (see Box 4 for details on the computation of spatially lagged variables).
Presence of primary sector (dummy)	Dummy variable; takes value of 1 if the community has a percent of experienced[1] labour force in primary sectors other than agriculture greater than zero, and value of 0 otherwise.
Community other primary sector (%)	Percent of experienced[1] labour force in primary sectors other than agriculture in 1981 at the CCS level.
Regional other primary sector (%)	Spatial lag of percent of experienced[1] labour force in primary sectors other than agriculture.
Presence of distributive services (dummy)	Dummy variable; takes value of 1 if the community has a percent of experienced[1] labour force in distributive services greater than zero, and value of 0 otherwise.
Community distributive services (%)	Percent of experienced[1] labour force in distributive services in 1981 at the CCS level.
Regional distributive services (%)	Spatial lag of percent of experienced[1] labour force in distributive services.
Presence of producer services (dummy)	Dummy variable; takes value of 1 if the community has a percent of experienced[1] labour force in producer services greater than zero, and value of 0 otherwise.
Community producer services (%)	Percent of experienced[1] labour force in producer services in 1981 at the CCS level.
Regional producer services (%)	Spatial lag of percent of experienced[1] labour force in producer services.
Agglomeration factors	
Local population density (people/km^2)	Total non-institutional population of a CCS divided by the total area of the CCS.
Regional population density (people/km^2)	Spatial lag of population density.
Size of nearest agglomeration (10,000 people)	1981 population of the nearest CMA or CA, expressed in 10,000 units. CMAs and CAs are defined according to the 1996 census geography.
Distance to larger agglomeration (km)	Distance between CCS centroid and centroid of the closest CMA of 500,000 people or more.
Distance to smaller agglomeration (km)	Distance between CCS centroid and centroid of the closest CMA or CA of less than 500,000 people.
Socio-economic factors	
Community economic specialization (index)	Herfindahl Index (HI) applied to experienced[1] labour force data; the index is the sum of the squares of the industry employment shares in 1981 (experienced labour force). Nine major industry groups are used in the computation, which include: agriculture, other primary sectors, traditional manufacturing, complex manufacturing, construction, distributive, business, consumer, and public services. If all 9 sectors had an equal share of employment, the HI would be 0.11 and if one sector employed all the workers, the HI would be 1.
Regional economic specialization (index)	Spatial lag of Herfindahl Index.
Community educational attainment (%)	Percent of population 25-54 years of age in 1981 with some post secondary education.
Regional educational attainment (%)	Spatial lag of percent of population 25-54 years of age with some post secondary education.
Community labour force participation rate (%)	Experienced[1] labour force 15 years and over divided by total population 15 years and over in 1981
Regional labour force participation rate (%)	Spatial lag of participation rate.

See note at end of table.

Appendix Table A1 The variables used in this study (continued)

Indicator	Description and specification
Other demographics	
Population less than 15 years of age (%)	Percent of total population that was below 15 years of age in 1981.
Population 55 to 74 years of age (%)	Percent of total population that was between 55 and 74 years of age in 1981.
Presence of young in-comers (dummy)	Dummy variable; takes value of 1 if the community has a percent of population 20-24 who lived in a different CSD 5 years before the census year greater than zero, and value of 0 otherwise.
Young who recently moved in (%)	Percent of population 20-24 who lived in a different CSD 5 years before 1981
Presence of senior in-comers (dummy)	Dummy variable; takes value of 1 if the community has a percent of population 55-74 who lived in a different CSD 5 years before the census year greater than zero, and value of 0 otherwise.
Seniors who recently moved in (%)	Percent of population 55-74 who lived in a different CSD 5 years before 1981
Presence of Aboriginal population (dummy)	Dummy variable; takes value of 1 if the community has some population that is reporting Aboriginal ethnicity in 1981, and value of 0 otherwise.
Aboriginal population (%)	Percent of total population that reported Aboriginal ethnicity in 1981.
Macro-regions	Five macro-regional dummy variables are used *Atlantic* includes Nova Scotia, New Brunswick, and Prince Edward Island; *Quebec* and *Ontario* include the homonymous provinces respectively; Manitoba / Saskatchewan and Alberta / British Columbia (which is the base category in the regression).
Provinces	The following provincial dummies takes value of 1 if the CCS is located in the given province: Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia (base category in the regression).

Note: For details on the computation of spatially lagged variables, see Box 4.

1. The experienced labour force includes all individuals employed during the week before the census plus, for those unemployed, those who had been employed at any time since January 1st of the previous year.

Appendix Table A2 Descriptive statistics

	All communities				Rural		Urban	
	Mean	S.D.	Min	Max	Mean	S.D.	Mean	S.D.
Dependent:								
Population change (change from 1981 to 2006, as a percent of the 1981 population level)	10.71	45.43	-87.08	709.39	1.80	34.75	43.64	62.12
Sector restructuring factors								
Presence of agriculture (dummy)	0.86	0.34	0.00	1.00	0.85	0.36	0.93	0.25
Community agriculture (%)	15.45	17.30	0.00	86.36	18.27	18.21	5.05	6.51
Regional agriculture (%)	16.15	13.25	0.06	60.07	17.57	13.94	10.92	8.42
Presence of other primary sector (dummy)	0.61	0.49	0.00	1.00	0.57	0.50	0.76	0.43
Community other primary sector (%)	5.04	8.35	0.00	71.61	5.61	8.76	2.93	6.14
Regional other primary sector (%)	4.44	4.41	0.30	34.67	4.73	4.55	3.37	3.64
Presence of distributive services (dummy)	0.99	0.09	0.00	1.00	0.99	0.11	1.00	0.00
Community distributive services (%)	19.75	6.88	0.00	62.80	18.65	6.89	23.82	5.09
Regional distributive services (%)	19.83	2.70	11.88	32.35	19.41	2.56	21.39	2.63
Presence of producer services (dummy)	0.80	0.40	0.00	1.00	0.76	0.43	0.97	0.17
Community producer services (%)	4.89	3.73	0.00	41.69	4.17	3.51	7.53	3.34
Regional producer services (%)	4.97	1.62	0.66	14.02	4.61	1.33	6.30	1.91
Agglomeration factors								
Local population density (people/km^2)	59.50	297.08	0.01	6,095.99	12.26	16.47	234.22	612.73
Regional population density (people/km^2)	70.51	161.28	0.06	2,947.78	40.44	40.75	181.72	317.02
Size of nearest agglomeration (10,000 people)	15.39	41.78	1.05	311.44	9.35	23.62	37.71	74.25
Distance to larger agglomeration (km)	263.91	250.81	4.47	1,335.98	282.03	257.03	196.91	213.57
Distance to smaller agglomeration (km)	53.63	49.90	0.15	860.02	60.27	50.51	29.08	38.70
Socio-economic factors								
Community economic specialization (index)	0.20	0.08	0.10	0.75	0.20	0.08	0.18	0.04
Regional economic specialization (index)	0.20	0.05	0.14	0.45	0.20	0.05	0.18	0.03
Community educational attainment (%)	32.14	11.34	3.20	74.47	29.78	10.56	40.85	9.75
Regional educational attainment (%)	32.55	6.59	16.01	59.69	31.49	6.16	36.47	6.68
Community labour force participation rate (%)	56.90	8.47	15.49	86.34	55.39	8.30	62.52	6.49
Regional labour force participation rate (%)	57.21	4.96	42.76	69.49	56.54	4.80	59.70	4.74
Other demographics								
Population less than 15 years of age (%)	25.08	4.60	6.25	47.50	25.00	4.72	25.38	4.11
Population 55 to 74 years of age (%)	16.06	5.43	2.18	44.25	16.85	5.45	13.16	4.25
Presence of young in-comers (dummy)	0.96	0.20	0.00	1.00	0.95	0.22	0.99	0.12
Young who recently moved in (%)	28.65	15.25	0.00	100.00	27.86	15.76	31.56	12.79
Presence of senior in-comers (dummy)	0.88	0.32	0.00	1.00	0.86	0.35	0.96	0.19
Seniors who recently moved in (%)	11.23	8.76	0.00	60.00	10.60	8.87	13.54	7.93
Presence of Aboriginal population (dummy)	0.48	0.50	0.00	1.00	0.40	0.49	0.77	0.42
Aboriginal population (%)	2.40	8.95	0.00	97.50	2.60	9.75	1.64	4.88

Note: S.D. indicates the standard deviation of the mean. See Appendix Table A1 for variable definitions and units of measure. All variables are for 1981 if not otherwise indicated. Averages are computed as unweighted averages of CCS level values; hence they are not to be interpreted as a national population average.

Source: Author's computation based on Census of Population data for 1981 and 2006.

Appendix Table A3 Population growth model: all communities, rural and urban, 1981 to 2006

Dependent: Logarithm of ratio of 2006 population divided by 1981 population	**All communities**		**Rural**		**Urban**	
	β	t-stat	*β*	t-stat	*β*	t-stat
Intercept	-1.468	-3.030	**-2.319**	-4.340	-0.983	-0.890
Industry restructuring factors						
Presence of agriculture (dummy)	-0.016	-0.730	0.021	0.880	-0.056	-0.910
Community agriculture (ln)	**-0.019**	-2.710	**-0.037**	-4.330	0.022	1.550
Regional agriculture (ln)	**-0.042**	-2.870	**-0.056**	-3.470	-0.029	-1.100
Presence of other primary sectors (dummy)	0.010	0.710	**0.045**	3.050	-0.046	-1.400
Community other primary sectors (ln)	**-0.043**	-5.710	**-0.056**	-6.530	**-0.031**	-1.860
Regional other primary sector (ln)	0.000	-0.050	0.004	0.380	-0.014	-0.510
Presence of distributive services (dummy)	**-0.257**	-3.270	**-0.199**	-2.560	...	...
Community distributive services (ln)	**0.085**	4.560	**0.054**	2.790	**0.183**	2.950
Regional distributive services (ln)	-0.005	-0.100	-0.002	-0.030	-0.092	-0.760
Presence of producer services (dummy)	**-0.078**	-2.840	**-0.074**	-2.530	-0.035	-0.340
Community producer services (ln)	**0.041**	2.860	**0.031**	2.000	0.027	0.710
Regional producer services (ln)	0.013	0.520	-0.009	-0.350	0.066	0.940
Agglomeration factors						
Local population density (ln)	**-0.036**	-5.810	**-0.039**	-4.930	-0.014	-1.150
Regional population density (ln)	0.022	1.530	0.012	0.660	0.005	0.310
Size of nearest agglomeration (ln)	**0.015**	2.800	0.008	1.370	0.018	1.480
Distance to larger agglomeration (ln)	**-0.100**	-8.850	**-0.103**	-7.400	**-0.082**	-4.430
Distance to smaller agglomeration (ln)	**-0.019**	-3.340	**-0.038**	-3.220	-0.006	-0.800
Socio-economic factors						
Community economic specialization (ln)	**-0.218**	-7.910	**-0.198**	-7.180	**-0.177**	-1.730
Regional economic specialization (ln)	**-0.180**	-3.580	**-0.211**	-3.180	-0.072	-0.710
Community educational attainment (ln)	**0.050**	2.870	**0.039**	2.240	-0.007	-0.110
Regional educational attainment (ln)	**0.165**	3.260	**0.102**	1.920	**0.364**	2.790
Community labour force participation rate (ln)	0.099	1.420	0.078	1.060	0.248	1.330
Regional labour force participation rate (ln)	0.011	0.070	**0.361**	2.210	**-0.542**	-1.800
Other demographics						
Population less than 15 years of age (ln)	0.068	1.610	0.005	0.130	**0.328**	2.590
Population 55 to 74 years of age (ln)	-0.008	-0.280	**0.077**	2.660	-0.089	-1.290
Presence of young in-comers (dummy)	-0.070	-1.600	-0.057	-1.310	-0.307	-1.620
Young who recently moved in (ln)	**0.025**	2.180	**0.026**	2.180	0.047	1.180
Presence of senior in-comers (dummy)	**-0.181**	-7.140	**-0.138**	-5.470	**-0.360**	-3.660
Seniors who recently moved in (ln)	**0.102**	11.330	**0.080**	8.670	**0.141**	5.540
Presence of Aboriginal population (dummy)	0.007	0.640	0.008	0.750	-0.005	-0.160
Aboriginal population (ln)	0.010	1.300	**0.028**	2.810	**-0.023**	-1.800
R^2	0.570		0.540		0.510	
Number of observations (CCSs)	2,382		1,875		507	

Note: The definition of rural and urban is presented in Box 2. Variable definitions are presented in Appendix Table A1. Figures in bold indicate statistical significance at the 10% significance level or higher; White robust standard errors are used to account for the possible failure of the assumption of normality and homogeneity of the variance of the residuals (Stock and Watson, 2007).

Source: Author's estimation based on Census of Population data for 1981 and 2006.

Appendix Table A4 Population growth model: macro-regions, 1981 to 2006

Dependent: Logarithm of ratio of 2006 population divided by 1981 population	**Atlantic**		**Quebec**		**Ontario**		**Manitoba / Saskatchewan**		**Alberta / British Columbia**	
	β	t-stat	*β*	t-stat	*β*	t-stat	*β*	t-stat	*β*	t-stat
Intercept	**-3.506**	-2.970	-1.470	-1.480	-0.123	-0.080	-3.607	-1.380	4.697	1.060
Industry restructuring factors										
Presence of agriculture (dummy)	0.031	1.120	-0.012	-0.350	-0.010	-0.180	-0.064	-0.340	**0.177**	2.030
Community agriculture (ln)	**0.026**	2.160	**-0.032**	-2.920	0.009	0.540	**-0.054**	-2.020	0.022	0.830
Regional agriculture (ln)	-0.020	-0.980	**-0.185**	-7.090	-0.082	-1.590	-0.029	-0.140	-0.023	-0.680
Presence of other primary sector (dummy)	**0.115**	2.890	0.000	0.010	0.000	0.000	0.002	0.050	-0.083	-0.590
Community other primary sector (ln)	**-0.055**	-3.410	**-0.036**	-3.270	-0.023	-1.470	**-0.040**	-2.110	**-0.099**	-2.780
Regional other primary sector (ln)	**0.086**	2.100	-0.007	-0.420	-0.008	-0.340	-0.009	-0.440	0.064	0.890
Presence of distributive services (dummy)	**-0.251**	-2.390	**-0.181**	-1.790	**-0.544**	-1.790	-0.158	-0.970	**-2.893**	-6.080
Community distributive services (ln)	**0.101**	2.900	**0.069**	2.640	**0.082**	1.660	0.021	0.520	0.100	0.980
Regional distributive services (ln)	0.042	0.440	**-0.219**	-2.650	0.063	0.370	**-0.497**	-2.370	-0.384	-1.220
Presence of producer services (dummy)	-0.041	-1.170	0.041	1.010	**-0.296**	-2.970	**-0.101**	-2.090	…	…
Community producer services (ln)	0.018	0.900	-0.003	-0.140	**0.152**	3.240	0.024	0.850	0.007	0.110
Regional producer services (ln)	**-0.065**	-1.810	**0.083**	2.270	-0.031	-0.360	**0.151**	2.120	**0.430**	1.970
Agglomeration factors										
Local population density (ln)	**-0.023**	-2.250	**-0.066**	-5.300	**-0.060**	-4.010	-0.013	-0.710	**-0.040**	-1.980
Regional population density (ln)	**0.119**	5.170	-0.004	-0.120	-0.003	-0.110	**0.075**	3.120	-0.026	-0.920
Size of nearest agglomeration (ln)	0.000	-0.020	0.003	0.380	0.013	1.110	**0.029**	2.050	0.030	1.350
Distance to larger agglomeration (ln)	**-0.152**	-4.100	**-0.135**	-6.910	**-0.111**	-2.740	-0.062	-1.420	**-0.127**	-3.120
Distance to smaller agglomeration (ln)	-0.003	-0.440	**-0.045**	-3.480	-0.011	-0.880	**-0.045**	-2.790	**-0.023**	-2.610
Socio-economic factors										
Community economic specialization (ln)	**-0.138**	-2.290	**-0.236**	-4.220	**-0.118**	-1.830	**-0.247**	-4.220	**-0.475**	-2.930
Regional economic specialization (ln)	-0.126	-0.820	-0.002	-0.020	**-0.377**	-2.000	-0.267	-1.240	0.232	0.930
Community educational attainment (ln)	0.039	0.940	**0.040**	1.690	**0.128**	2.920	0.043	1.070	**0.455**	3.870
Regional educational attainment (ln)	**0.315**	2.450	0.022	0.230	**0.457**	2.510	-0.002	-0.010	**0.858**	2.280
Community labour force particip. rate (ln)	**0.289**	2.740	0.137	1.430	0.107	0.440	-0.006	-0.060	-0.302	-0.630
Regional labour force particip. rate (ln)	0.205	0.700	**0.572**	2.800	-0.281	-0.660	0.921	1.600	**-1.634**	-2.500
Other demographics										
Population less than 15 years of age (ln)	0.063	0.680	0.003	0.050	**-0.170**	-1.800	0.162	1.990	0.031	0.130
Population 55 to 74 years of age (ln)	-0.043	-0.670	-0.021	-0.470	**-0.137**	-1.900	0.035	0.590	-0.110	-0.720
Presence of young in-comers (dummy)	-0.020	-0.200	**-0.127**	-2.270	-0.155	-1.190	-0.021	-0.250	…	…
Young who recently moved in (ln)	0.015	0.710	**0.059**	3.830	0.041	1.180	-0.012	-0.540	**0.236**	2.180
Presence of senior in-comers (dummy)	-0.003	-0.070	**-0.198**	-5.530	**-0.348**	-3.650	-0.031	-0.680	**0.678**	2.340
Seniors who recently moved in (ln)	**0.040**	2.290	**0.097**	7.480	**0.139**	5.710	**0.044**	2.460	0.069	1.450
Presence of Aboriginal pop. (dummy)	0.001	0.030	0.011	0.530	0.011	0.470	-0.004	-0.140	-0.093	-0.730
Aboriginal population (ln)	**0.027**	2.080	-0.004	-0.160	-0.033	-1.570	**0.057**	5.250	0.034	1.450
R^2	0.640		0.520		0.510		0.670		0.730	
Number of observations (CCSs)	340		987		493		410		152	

Note: The definition of macro-region is presented in Box 2. Variable definitions are presented in Appendix Table A1. Figures in bold indicate statistical significance at the 10% significance level or higher; White robust standard errors are used to account for the possible failure of the assumption of normality and homogeneity of the variance of the residuals (Stock and Watson, 2007).

Source: Author's estimation based on Census of Population data for 1981 and 2006.

Appendix Table A5 Population growth model: weighted regression, 1981 to 2006

Dependent: Logarithm of ratio of 2006 population divided by 1981 population	All communities		All communities plus macro-regions		All communities plus provinces	
	β	t-stat	*β*	t-stat	*β*	t-stat
Intercept	**-1.905**	-2.15	**-2.067**	-2.17	**-1.835**	-1.9
Presence of agriculture (dummy)	0.032	0.87	0.034	0.95	0.016	0.44
Community agriculture (ln)	**0.048**	4.16	**0.059**	5.11	**0.06**	5.2
Regional agriculture (in)	**-0.061**	-3.7	**-0.081**	-4.7	**-0.114**	-4.44
Presence of other primary sectors (dummy)	0.001	0.06	0.013	0.65	0.015	0.72
Community other primary sectors (ln)	**-0.023**	-1.93	**-0.021**	-1.78	**-0.022**	-1.92
Regional other primary sector (ln)	-0.002	-0.11	0.021	1.05	0.009	0.45
Presence of distributive services (dummy)	**-0.226**	-1.81	**-0.312**	-2.54	**-0.318**	-2.57
Community distributive services (ln)	**0.115**	3.34	**0.14**	4.2	**0.142**	4.3
Regional distributive services (ln)	-0.095	-0.9	-0.073	-0.72	-0.11	-1.14
Presence of producer services (dummy)	**-0.084**	-2	**-0.089**	-2.14	**-0.104**	-2.6
Community producer services (ln)	**0.052**	2.14	**0.049**	2.08	**0.054**	2.31
Regional producer services (ln)	-0.054	-1.17	0.016	0.32	-0.022	-0.47
Local population density (ln)	-0.001	-0.06	-0.005	-0.52	-0.004	-0.38
Regional population density (ln)	**-0.034**	-3.01	**-0.067**	-5.02	**-0.072**	-5.13
Size of nearest agglomeration (ln)	**0.028**	2.61	**0.03**	3.11	**0.032**	3.34
Distance to larger agglomeration (ln)	**-0.069**	-5.83	**-0.084**	-6	**-0.08**	-5.37
Distance to smaller agglomeration (ln)	**-0.017**	-3.59	**-0.022**	-4.31	**-0.02**	-3.98
Community economic specialization (ln)	**-0.161**	-2.9	**-0.211**	-3.69	**-0.229**	-4.14
Regional economic specialization (ln)	**-0.241**	-3.48	-0.116	-1.51	-0.074	-0.81
Community educational attainment (ln)	0.059	1.37	0.065	1.53	0.063	1.48
Regional educational attainment (ln)	**0.414**	4.92	**0.632**	6.75	**0.594**	6.23
Community labour force participation rate (ln)	0.17	1.3	0.09	0.68	0.131	1.02
Regional labour force participation rate (ln)	-0.333	-1.58	-0.337	-1.55	-0.364	-1.64
Population less than 15 years of age (ln)	**0.33**	2.99	**0.264**	2.36	**0.306**	2.79
Population 55 to 74 years of age (ln)	**-0.11**	-1.84	**-0.138**	-2.24	**-0.132**	-2.18
Presence of young in-comers (dummy)	**-0.153**	-1.94	**-0.194**	-2.39	**-0.22**	-2.76
Young who recently moved in (ln)	0.038	1.55	**0.055**	2.19	**0.066**	2.67
Presence of senior in-comers (dummy)	**-0.328**	-6.77	**-0.349**	-7.19	**-0.344**	-6.81
Seniosr who recently moved in (ln)	**0.192**	10.1	**0.199**	10.44	**0.195**	10.25
Presence of Aboriginal population (dummy)	-0.004	-0.23	-0.002	-0.1	-0.001	-0.06
Aboriginal population (ln)	**-0.019**	-2.07	-0.013	-1.4	-0.015	-1.61
Atlantic	...	...	**0.163**	3.06	...	...
Quebec	...	...	**0.217**	3.85	...	...
Ontario	...	...	**0.227**	4.72	...	...
Manitoba / Saskatchewan	...	...	**0.096**	1.69	...	...
Newfoundland and Labrador	...	...	...	...	-0.043	-0.51
Prince Edward Island	...	...	...	...	0.098	1.44
Nova Scotia	...	...	...	...	**0.176**	2.85
New Brunswick	...	...	...	...	**0.158**	2.5
Quebec	...	...	...	...	**0.195**	2.92
Ontario	...	...	...	...	**0.214**	3.79
Manitoba	...	...	...	...	0.098	1.16
Saskatchewan	...	...	...	...	0.058	0.57
Alberta	...	...	...	...	0.015	0.25
R^2	0.62		0.64		0.64	
Number of observations (CCSs)	2,382		2,382		2,382	

Note: Variable definitions are presented in Appendix Table A1. Figures in bold indicate statistical significance at the 10% significance level or higher; White robust standard errors are used to account for the possible failure of the assumption of normality and homogeneity of the variance of the residuals (Stock and Watson, 2007).

Source: Author's estimation based on Census of Population data for 1981 and 2006.

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